

IN THE UNITED STATES DISTRICT COURT
FOR THE NORTHERN DISTRICT OF ILLINOI
EASTERN DIVISION

---o0o---

THE MAGNAVOX COMPANY, et al.,
Plaintiffs,

vs.

BALLY MANUFACTURING CORPORATION,
et al.,
Defendants.

Consolidated Civil
Actions Nos. 74-C-1030
and 74-C-2510

ATARI, INC.,
Plaintiff,

vs.

THE MAGNAVOX COMPANY and
SANDERS ASSOCIATES, INC.,
Defendants.

Civil Action
No. 75-C-3933

THE MAGNAVOX COMPANY and
SANDERS ASSOCIATES, INC.,
Plaintiffs,

vs.

SEARS ROEBUCK & COMPANY,
a corporation,
Defendants.

2 85480

Civil Action
No. 75-C-3153

---c0o---

DEPOSITION OF

NOLAN K. BUSHNELL

TUESDAY, JANUARY 13, 1976
WEDNESDAY, JANUARY 14, 1976
---o0o---

IRVIN C. SCHEIBE
CERTIFIED SHORTHAND REPORTER
520 DELLBROOK AVE.
SAN FRANCISCO, CALIF. 94131
TELEPHONE 566-3049

1 IN THE UNITED STATES DISTRICT COURT
2 FOR THE NORTHERN DISTRICT OF ILLINOIS
3 EASTERN DIVISION

4 ---o0o---

5 THE MAGANAVOX COMPANY, et al.,
6 Plaintiffs,

7 vs.

8 BALLY MANUFACTURING CORPORATION,
9 et al.,
Defendants.

Consolidated Civil
Actions Nos. 74-C-1030
and 74-C-2510

10 ATARI, INC.,
11 Plaintiff,

12 vs.

13 THE MAGNAVOX COMPANY and
14 SANDERS ASSOCIATES, INC.,
Defendants.

Civil Action
No. 75-C-3933

15 THE MAGNAVOX COMPANY and
16 SANDERS ASSOCIATES, INC.,
17 Plaintiffs,

18 vs.

19 SEARS ROEBUCK & COMPANY,
20 a corporation,
Defendants.

2 85481

Civil Action
No. 75-C-3153

21 ---o0o---

22 BE IT REMEMBERED, That pursuant to Notice of Taking Deposi-
23 tion, and on Tuesday, the 13th day of January, 1976, commencing
24 at the hour of 10:20 a.m. thereof, at the offices of Messrs.
25 Flehr, Hobbach, Test, Albritton & Herbert, 260 Sheridan Avenue,
26 Palo Alto, California, before me, Irvin C. Scheibe, a Notary
27 Public in and for the City and County of San Francisco, State
28 of California, personally appeared

1 NOLAN K. BUSHNELL.

2 called as a witness, who, being by me first duly sworn, was
3 thereupon examined and interrogated as hereinafter set forth.

4 Messrs. NEUMAN, WILLIAMS, ANDERSON & OLSON, represented by
5 JAMES T. WILLIAMS, Esq., 77 West Washington Street, Chicago,
6 Illinois 60602, appeared as counsel on behalf of The Magnavox
7 Company and Sanders Associates, Inc., there being also present
8 THOMAS A. BRIODY, Esq., Corporate Patent Counsel, Director,
9 Patent and Licensing Department, the Magnavox Company, and
10 LOUIS ETLINGER, Esq., Director, Patents and Licensing, Sanders
11 Associates, Inc. 2 85482

12 Messrs. FITCH, EVEN, TABIN & LEUDEKA, represented by
13 DONALD L. WELSH, Esq., 135 South La Salle Street, Chicago,
14 Illinois 60603, appeared as counsel on behalf of Bally
15 Manufacturing Corporation, et al.

16 Messrs. FLEHR, KOMBACH, TEST, ALBRITTON & HERBERT, repre-
17 sented by THOMAS O. HERBERT, Esq., 160 Sansome Street,
18 San Francisco, California 94104, appeared as counsel on behalf
19 of Atari, Inc., and Kee Games.

20 ---

21 MR. WILLIAMS: This is the deposition of Nolan K. Bushnell
22 and Atari, Inc., and is being taken pursuant to Notice in three
23 civil actions all pending in the Northern District of Illinois.

24 The first action is The Magnavox Company and Sanders
25 Associates versus Bally Manufacturing Corporation, et al., and
26 it is Consolidated Civil Actions No. 74-C-1030 and 74-C-2510.

27 The second action is Atari, Inc. versus The Magnavox Company
28 and Sanders Associates, Inc., Civil Action No. 75-C-3933.

1 The third action is The Magnavox Company and Sanders
2 Associates, Inc. versus Sears Roebuck and Company, Civil Action
3 No. 75-C-3153.

4 One initial matter, Mr. Herbert, as we talked about yester-
5 day, two previous depositions of Mr. Bushnell have been taken
6 in The Magnavox versus Bally, Action No. 75-C-1030 and I think
7 that we agreed to stipulate that those two depositions which
8 were taken on July 3, 1974 and July 14, 1975 could be used in
9 the Sears case, No. 75-C-3153 and the Atari case No. 75-C-3953
10 with the same force and effect as if they had also been taken
11 in those two actions.

12 MR. HERBERT: So stipulated.

13 --- 2 85483

14 NOLAN K. BUSHNELL,

15 called as a witness, having been first duly sworn by the Notary
16 Public to tell the truth, the whole truth, and nothing but the
17 truth, testified as follows:

18 EXAMINATION BY MR. WILLIAMS:

19 MR. WILLIAMS: Q. Would you state your full name, please,
20 Mr. Bushnell? A. Nolan K. Bushnell.

21 Q. Are you the same Nolan K. Bushnell whose deposition has
22 previously been taken in the civil actions just referred to,
23 Magnavox versus Bally? A. These two, yes.

24 Q. What is your present residence?

25 A. 15289 Top of the Hill Road, Los Gatos, California 95030.

26 Q. Are you presently employed? A. Yes, I am.

27 Q. By whom are you presently employed?

28 A. Atari, Incorporated in Los Gatos.

1 Q. What is your position with Atari, Inc.?
2 A. Chairman of the Board.
3 Q. Do you hold any other positions with Atari, Incorporated?
4 A. No, I do not.
5 Q. What are your present duties as chairman of the board?
6 A. Primary direction of the company, strategies, plans, future
7 developments.
8 Q. How long have you had those duties with Atari?
9 A. Approximately two and a half years.
10 Q. What were your duties with Atari prior to that time?
11 A. I was president of Atari.
12 Q. How did your duties when you were president differ from
13 your present duties? A. I was more involved in day-to-
14 day operations. **2 85484**
15 Q. How long were you the president of Atari?
16 A. Since its founding in February or March of 1972.
17 Q. And you were president from that time until you became
18 chairman of the board? A. That's correct.
19 Q. Have you ever held any positions with Atari other than
20 president or chairman of the board? A. No.

2 85485

17 Q. Would you briefly outline your education for us since high
18 school? I gather you graduated from high school?

19 A. Yes.

20 Q. What has been your education since that time?

21 A. I went to Utah State University in engineering, later in
22 business. I transferred to the University of Utah at which
23 I pursued a degree in economics and later graduated in engineer-
24 ing. Bachelor of Science Degree in Engineering.

25 Q. For how many years were you at Utah State University?

26 A. Approximately three.

27 Q. Three calendar years or three academic years?

28 A. Three academic years.

1 Q. When did you commence your studies at Utah State University?

2 A. It had to be 1961.

3 Q. So you were there from 1961 through 1964?

4 A. I believe that's true.

5 Q. When did you begin your studies at the University of Utah?

6 A. I actually started, I took a summer class at the University
7 of Utah in '62 or '63, but then I later lived closer to the
8 University than I did to Utah State and then I transferred full-
9 time to--

10 Q. Was that in September of 1964?

11 A. No. I believe I transferred mid-year. I believe I trans-
12 ferred the winter quarter.

13 Q. Of what year? A. I don't remember.

14 Q. Do you think it was approximately 1964 or 1965?

15 A. I think that's close enough.

2 85486

16 MR. HERBERT: I might say that among the things that you
17 have requested we are proposing to obtain some materials which
18 would more exactly set the dates that Mr. Bushnell was at Utah
19 State and the University of Utah and we do not have those items
20 but we will be getting them.

21 MR. WILLIAMS: Is that primarily the transcript you were
22 referring to?

23 MR. HERBERT: The transcript.

24 MR. WILLIAMS: Q. When did you graduate from the University
25 of Utah? When did you get your degree?

26 A. I graduated in the class of '69, but I graduated mid-year
27 and it was December of '68, I believe.

28 Q. While you were in college were you a full-time student, or

1 were you employed part time?

2 A. I was employed all the time.

3 Q. Can you give us an outline of the jobs you held while you
4 were in college? A. Sure. I went to work for

5 Litton Guidance Systems. I worked for a furniture store named
6 Barlow Furniture, TV repair and appliance repair and delivery.

7 I was an assembler and a test tech at Litton Guidance Systems.

8 I worked during the school year for Hadley, Limited which is a
9 clothing store. I worked for one of the industrial engineering

10 departments for awhile. I don't remember exactly who the

11 professor was. Then I worked for my own company which was an

12 advertising company for several summers, and I worked at

13 Lagoon Corporation as manager of the games department.

14 Initially I started working at Lagoon as just someone--you know,

15 as one of the employees and was made manager three seasons later

16 or two seasons later.

2 85487

17 Q. Did you hold any other jobs while you were in college?

18 A. Oh, I sold Encyclopedia Americana for awhile. I operated
19 some coin machines at Lagoon in Salt Lake City. That's about
20 it of any substance.

21 Q. Do you recall approximately the period of time which you
22 worked for Litton Guidance Systems?

23 A. I think that was in '61 or--I think it was the summer of
24 '62.

25 Q. Just during the summer of '62?

A. Yes.

26 Q. And you said you worked for one of the industrial engineer-
27 ing departments. Do you recall what period that was?

28 A. I think that was the fall quarter of '62 or '63. It was for

1 one of the professors.

2 Q. What were your duties in this job?

3 A. Draftsman. Some design.

4 Q. Design of what? A. Irrigation systems.

5 Q. Agricultural irrigation systems? A. Yes.

6 Q. When did you commence your employment with Lagoon Corpora-
7 tion? A. I started in the summer of '63.

8 Q. How long were you with Lagoon?

9 A. I was with Lagoon for five years.

10 Q. Was your employment with Lagoon continuous over that five-
11 year period or were there breaks in it? 2 85488

12 A. It was hot and heavy, of course, during the summer months.
13 It fit very well with an academic career because there were
14 always plans that were made and things that were being done
15 all year long and it was a situation where we could put in as
16 many hours as we wanted to as long as it was a job-related--
17 you know, that there was the work to do and generally it was
18 pretty much part-time work during the winter months.

19 Q. But there was not a period during that five-year period
20 when you weren't employed by Lagoon either on a full-time or
21 a part-time basis?

22 A. It was kind of a thing where I always knew the people and
23 any time I wanted to work I could. It was hard to say, you
24 know, when I was not employed and when I was with the relation-
25 ship that we had.

26 Q. Were you paid on an hourly basis or a salary basis?

27 A. Hourly. After I was manager it was essentially a salary
28 because it was fixed, you know, a fixed amount and you made the

1 big thing on the profit-sharing basis. We had Christmas bonuses
2 that generally would finance the fall and winter quarter.

3 Q. You said initially when you were with Lagoon that you were
4 initially just an employee. What were your first duties when
5 you first went to work for Lagoon?

6 A. My first duties were I was the Spill The Milk operator.
7 That's a game in which a patron attempts to knock over milk
8 bottles with baseballs. You stand out and say, "Step right up
9 and come and play the games and win a stuffed animal."

10 Q. And this was at an amusement center of some type operated
11 by Lagoon?

12 A. Well, Lagoon Corporation is an amusement park outside of Salt Lake City.

13 Q. After you were the Spill The Milk operator, what were your
14 next duties for Lagoon?

2 85489

15 A. Well, after about a half a season I became--you know, they
16 moved us around and I ran Shooting Waters and Guess Your Weight,
17 Bowling and Tip 'Em Over and Flukie-Ball.

18 Q. Did you have any connection with coin-operated amusement
19 machines during that period of your employment?

20 A. Yes, I did. Bowling was a game that we had which I was an
21 operator on for a month and it involved maintenance of the
22 machines as well as selling.

23 Q. As well as selling what? A. Well, getting people
24 to play the games.

25 Q. But Bowling was a coin-operated game?

26 A. Yes, it was. Skee-Ball was also a coin-operated game which
27 I operated.

28 Q. How many employees did Lagoon Corporation have when you

1 first went to work for them?

2 A. During the peak of the season, during the summer months--
3 and there were actually three corporations, but they were all
4 owned and run by the same one. So when I talk about Lagoon
5 Corporation it's actually Amusement Services that was the
6 corporation that I worked for, but it was all considered to be
7 Lagoon even though I don't know why they had been separated
8 that way.

9 Q. What were the other two corporations?

10 A. The Fun House Corporation. I think that was the name of it,
11 something like that. I think they split that out because the
12 Fun House is an extremely high-liability thing. People are
13 always breaking arms and legs and things like that. So I think
14 from a liability standpoint they had it separated out.

15 Q. What was the third corporation?

2 85490

16 A. Lagoon Corporation. Amusement Services ran the food
17 operations and the games. Lagoon Corporation owned all the
18 heavy capital equipment, rides, everything with the exception
19 of the roller coaster. I think the roller coaster was a
20 separate corporation also and, again, I think it was from the
21 liability standpoint.

22 Q. Did Lagoon Corporation have any arcades with coin-operated
23 pinball machines and things such as that?

24 A. Yes, they did.

25 Q. Were the arcades located in the--

26 A. Well, that was Amusement Services again that had the
27 arcades, not Lagoon Corporation, if we're going to divide those.

28 Q. Were the arcades located in the park?

1 A. Yes, they were.

2 Q. When you were made a manager were you still employed by
3 Amusement Services or were you employed by Lagoon?

4 A. It was all Amusement Services.

5 Q. When you were made a manager for Amusement Services what
6 were your duties?

7 A. It was to essentially operate the complete games department.
8 I had P and L responsibility, hiring, firing, maintenance
9 responsibility, planning responsibility.

10 Q. What types of games were included in the games department?

11 A. Coin-operated games, ball-throwing games, penny pitches,
12 shooting games, arcade, quick-draw games, guess-your-weight
13 games, basketball-throwing game, High Strikers, Skee-Ball,
14 photo studio, coin-operated photo machines, water-pistol games.
15 Let's see, what were some of the others? Rollidown, Fun Balls,
16 darts, Bingoring which is a coin-operated game, Bang. That's
17 about it.

18 Q. You said Bingoring was a coin-operated game?

19 A. Yes.

2 85491

20 Q. Could you describe the game of Bingoring?

21 A. Well, it has a series of holes which you roll a ball down
22 and attempt to get a bingo. Each of the holes are numbered
23 and it lights a light on the back. You get certain patterns,
24 you win points which can be traded for prizes. Oh, baseball
25 was another one.

26 Q. You mentioned that one of the areas was an arcade. Would
27 you briefly describe what the arcade was or what it contained?

28 A. Well, it was a traditional penny arcade which had various

1 things that you can do. The direct responsibility for the
2 arcade was a fellow called Steve Hyde. It contained photocard
3 machines, pinball machines, peep shows--not the X-rated kind,
4 out, you know, look and see the San Francisco Earthquake and
5 that kind of stuff. There were a few that the little boys
6 thought were really racy at that time, but it's nothing in
7 comparison with what we have now. It also vended fish food to
8 feed to the carp in the lake. Skiing machines, baseball
9 machines. Hockey machines. Driving machines. Just the
10 regular stuff you see in any amusement park arcade.

11 Q. You said Steve Hyde had responsibility for the penny arcade?

12 A. Yes.

13 Q. Did Mr. Hyde report to you or did you report to Mr. Hyde?

14 A. He reported on equal level to Mr. Freed. **2 85492**

15 Q. F-r-e-e-d?

A. Yes. We shared P and L
16 responsibility and maintenance responsibility of the equipment.

17 Q. As manager was it your responsibility to select the games
18 that were run by Amusement Services Corporation?

19 A. Only those which were out on the midway. Mr. Hyde and I
20 would discuss the things, but it was ultimately Mr. Freed's
21 decision as to capital equipment purchases. We would both
22 make recommendations.

23 Q. How many employees did you have reporting to you while you
24 were manager? A. 60 to 100.

25 Q. What was Mr. Freed's position?

26 A. He was president of Amusement Services. He might have been
27 general manager, I'm not sure. He was the man, though. He
28 was the boss. I'm not sure exactly what his title was.

1 Q. Did you find that when you and Mr. Hyde made recommendations
2 concerning the games to be purchased by Mr. Freed that he often
3 accepted your advice? A. Yes, he did.

4 Q. How long did you remain a manager of the Amusement Services
5 Corporation? A. I was manager for three years.

6 Q. During that entire period your duties were as you just
7 outlined them for us? A. Yes.

8 Q. At the end of this period did you then leave Amusement
9 Services Corporation? A. Yes, I did.

10 Q. What was your next employment after that?

11 A. Ampex Corporation.

12 Q. I think you stated that for a period while you were in
13 college you were employed by Barlow Furniture doing TV and
14 appliance repairwork and delivery?

15 A. That's correct.

2 85493

16 Q. Could you outline the nature of your duties concerning
17 television repair? A. I was really good at switch-

18 ing tubes around. I didn't have the capital equipment to do
19 some of the heavy repairing. That was left up to some of the
20 other people.

21 Q. You say you didn't have the capital equipment?

22 A. Yes.

23 Q. Were you working as a contractor for Barlow essentially,
24 or-- A. No. I was just employed on a salary.
25 Hourly, actually.

26 Q. But were you using your own equipment, your own television-
27 repair equipment? A. Yes. I had my own pliers.

28 Q. Prior to that time that you worked for Barlow did you

1 have any background in television service or--

2 A. Well, I played around with ham radio. I had a ham radio
3 license in 1955, I guess. I was one of the youngest ham radio
4 operators in Utah. That was when I was about ten or eleven,
5 I guess. I just always fooled around. I fixed my own TV's
6 and then pretty soon I started fixing the neighbors' TV's and,
7 you know, it just kind of mushroomed. I worked for Barlow,
8 incidentally, all during the high school. It was just kind of
9 one of these evolutionary things.

10 Q. While you were working for Barlow all during high school
11 during that entire period you were involved in fixing and
12 repair of televisions?

13 A. That's true. It
14 wasn't my primary responsibility. I'd say I was a better
washerwoman. We were at RCA at that time.

15 Q. You were what? A. RCA at that time.

16 Q. Barlow was RCA? A. Yes.

17 Q. You mean they were an RCA dealer?

18 A. Right. He didn't like the Magnavox guy down the street.

2 85494

2 Q. You said while you were in college you operated some coin
3 machines on a route in Salt Lake City?

4 A. That's correct.

5 Q. When did you start operating coin machines that way?

6 A. It had to be about 1965, I think. Each year in the arcade
7 they'd junk some machines or sell them off to employees for
8 five bucks. I'd repair them and fix them up and put them
9 around in some fraternity houses at school and keep them operat-
10 ing and collect the money and split the revenue with the house
11 manager of the fraternity houses.

12 Q. And over how many years did you do that?

13 A. Three years.

2 85495

14 Q. So you did it until approximately the time you left Amuse-
15 ment Services?

16 A. Yes. I sold my route at the time
17 to one of my fraternity brothers.

18 Q. And you had control over which games you placed where in
19 your route?

A. Yes, I did.

20 Q. Did you have any employees?

A. No, I didn't.

21 Q. What type of coin machines did you place in various places
22 on the route?

23 A. Primarily they were baseball
24 machines. The sports games always seemed to do very well.

25 Q. Would you describe what you mean by baseball machine?

26 A. It was a machine which essentially consisted of two buttons
27 as far as player controls. One controlled the pitch and the
28 other one controlled the bat. You pushed the pitch button and
it would roll a steel ball down toward the bat which, when you
pushed on it, it would hit the ball up into a series of holes

1 along the back. If you hit it in the center hole you'd get a
2 home run and the little man would run around the playfield. If
3 you hit one to the corners you'd get a single or if you hit
4 another place you'd get an out. The object was to obviously
5 hit the best holes without hitting the out, and if you got
6 three outs the game would be over. There were several variations
7 on that basic theme. Some of them would have little ramps that
8 if you hit the ramp it would knock it up into the bleachers
9 which would be a special home run and it would give you three
10 runs or something like that.

11 Q. Is there any other type of machine that you placed other
12 than baseball machines?

2 85496

13 A. There was one that was called a Boozarometer which
14 essentially was a stick or a wand that had a ring on it that
15 was captive on a wiggly piece of wire, and you would put in a
16 coin and attempt to not touch the wire while moving this spring
17 around. If you touched it the game would be over and a bell
18 would ring. So the idea was to get it clear across the wire
19 without touching it, which was a difficult task. It supposedly
20 was more difficult when you had been drinking than if you
21 hadn't been.

28

Q. You stated that you graduated with a BS in Engineering; is

1 | that correct?

A. Correct.

2 Q. Any particular field of engineering?

3 A. Electrical engineering. Essentially it was a computer-
4 oriented electrical engineering degree that I had.

5 Q. What do you mean by computer-oriented?

6 A. Logic design, systems design, software.

7 Q. You mean you took courses in logic design and systems design
8 itself? A. Yes. You had many electives

8 A. Yes. You had many electives
9 internal to the engineering department that you could major in
10 like power distribution, you could major in circuits or you
11 could major in semiconductors, or you could major in computer
12 design, and based on the engineering electives that you took
13 it would pretty much determine, you know, where your interest
14 was and ultimately where your job would be.

3 MR. WILLIAMS: Q. Were you personally involved in any
4 activities prior to December 31, 1969 relating to apparatus
5 for playing of games which utilized cathode ray tube displays?

6 A. Yes, I was.

7 Q. What was the first such activity of that kind that you can
8 recall?

9 A. I recall playing a game on a
10 computer at the University of Utah.

11 Q. And that was the first activity of that nature that you can
12 recall that you were involved in?

13 A. Yes, on a cathode-ray tube.

2 85498

14 Q. When did that activity occur?

15 A. I have been trying to pinpoint that. I think it was in
16 the neighborhood of 1965. It was shortly after I came to the
17 University of Utah.

18 Q. By shortly after you came to the University of Utah, how
19 long a period do you mean by shortly?

20 A. I really don't recollect. It was one of those things that
21 I just didn't think that much about it at the time. The
22 University of Utah had a strong computer center, a graphics
23 laboratory. The games that were programmed were there and
24 pretty much a common knowledge. I had a friend in the engineer-
25 ing department that I used to play chess with that said,
26 "There's some great games over at the computer center." and we
27 went over one night and played.

28 Q. What was the friend's name?
Jim Davies, I think.

A. His name was

1 Q. And you knew him through your work at the University of
2 Utah? A. No. I knew him through the chess club.

3 Q. Do you know where Mr. Davies is located today?

4 A. I have no idea. I'm not really sure that Davies is his
5 last name. In fact, just a second. I'm not sure that Jim
6 Davies isn't another guy. It's Jim something, and it started
7 with a D, but I'm not sure.

8 Q. Do you recall when you last saw this individual that took
9 you to the computer center? 2 85499

10 A. It was during that academic year. He was a senior, I
11 believe, at that time or a graduate student and I really don't
12 know which. You know, a casual acquaintance. We used to have
13 coffee together and talk about politics and philosophy and that
14 sort of thing after chess and I think he graduated and left the
15 school year at that time.

16 Q. Could you describe the game which you saw on a computer at
17 the University of Utah, this first game that you saw?

18 A. Yes. It was a game which was called Space War.

19 Q. Could you describe how Space War was played?

20 A. Gee, don't you know by now? It's a rocket ship game in
21 which you fire missiles at the other rocket ships. In some
22 versions there is a sun and in some versions there aren't, and
23 I don't remember whether this one had a sun or not. It turns
24 out having a sun with gravity is one of the tougher programming
25 problems.

26 Q. On this first occasion when you saw this game you just
27 walked into the computer center and the game was being played
28 at that time? A. No. We went in the graphics

1 lab and the guy said to the fellow that was there, "Can we get
2 some time to play Space War?"

3 And the guy said, "Sure," and something happened and a few
4 minutes later Space War came up on the screen.

5 Q. And the game was played on a computer, you say?

6 A. It was played--

7 Q. Using a computer?

A. Yes.

8 Q. What kind of a computer was it being used? 2 85500

9 A. I'm not sure. That's one of the things that I can't put
10 the time on it. It was either a Univac 1108 or an IBM 7094.

11 The University of Utah changed computers while I was there and
12 I'm not sure which one it was, really.

13 Q. But you believe it was one of those two?

14 A. Yes. I tend to think it was the Univac 1108.

15 Q. You said the University had changed computers while you
16 were there. Did they change from a Univac 1108 to an IBM 7094
17 or vice versa?

A. No. You never change in that
18 direction. It changed to an 1108.

19 Q. I think we are going to go a little more deeply into your
20 recollection of the game of Space War?

21 A. Okay.

22 Q. You say there were rocket ships?

A. Right.

23 Q. How did the rocket ships appear on the screen?

24 A. In a side view rockets. When you pushed a button a missile
25 issues forth from the nose, travels across the screen. If you
26 hit the opponent's rocket ship it explodes and you score a
27 point.

28 Q. Can the player control the position of the rocket ship?

1 A. Yes, they can.

2 Q. How does he do that? A. This one was a four-
3 button model. You push buttons to rotate the rocket ship right,
4 counterclockwise or clockwise. If you pushed one button it
5 would rotate clockwise, and if you pushed the other button it
6 would rotate counterclockwise. Then you had a thrust button
7 which would give acceleration in the direction that the rocket
8 was pointed or deceleration as the case may be. The other
9 button was the fire missile button.

10 Q. Where were the buttons located?

2 85501

11 A. They were in a little box. It was about like this
12 (indicating). It was hooked somewhere into the bowels of the
13 machine.

14 Q. Did each player have a box? A. Yes.

15 Q. How many players were there? A. Two.

16 Q. You say when a torpedo hit a rocket there was an explosion.
17 How did the explosion appear on the screen?

18 A. I think it says, "Bang," or "Boom," or something. I've
19 seen several versions of this and I'm a little fuzzy which
20 version the first one I saw was. But I believe it said "Bang,"
21 and then the rocket ship disintegrated or turned into a series
22 of dots and then the rocket ships would start again from the
23 opposite corners of the universe.

24 Q. You say it said "Bang." What said "Bang"?

25 A. It printed out "Bang" on the screen.

26 Q. Over a relatively small portion of the screen or across
27 the entire screen? A. I have seen it both ways.

28 I believe this was a small "Bang" in regular, you know, say,

1 quarter-inch high characters.

2 Q. You said that one rocket ship disintegrated. What do you
3 mean by disintegrated?

4 A. I think it just turned
5 into some dots. You know, it's one of those things.

6 Q. Did the dots go off in different directions, or did the
7 dots stay in the same spot that the rocket ship had before it
8 disintegrated?

9 A. I don't remember.

10 Q. While the rocket ship was disintegrating, did the dots or
11 whatever appear to keep on moving with the same velocity the
12 rocket ship had before?

13 A. I don't remember.

14 Q. What kind of a display was used in connection with the
15 games you saw?

16 A. I really don't know. There's
17 a screen, I think it was a 12 to 14-inch screen. 2 85502

18 Q. Was it a rectangular screen or a circular screen?

19 A. I don't really remember. I think the viewing area for the
20 game was rectangular. Now, whether that was housed in a
21 circular tube or a square tube I don't remember.

22 Q. What do you mean by the viewing area?

23 A. Well, you would fly off the screen up and you would enter
24 the bottom, but you wouldn't really fly off the screen, you'd
25 just see half of your rocket ship disappear and the other half
26 would come up through the bottom.

27 Q. Was this operation you described of flying off the top of
28 the screen and coming on the bottom, was that common to all the
different versions of Space War that you saw?

A. Later than that I've seen one which, you know, there was
essentially a boundary that you had to stay inside of and in
some of the versions if you hit the boundary the rocket ship

1 Q. When you first saw this Space War game on this first
2 occasion that we're talking about, did you play the game your-
3 self?

A. Yes, I did.

4 Q. Did you play it with another person? A. Yes.

5 Q. Do you know who that other person was?

6 A. It was this Jim Davies, but I don't think that's right.
7 Jim D.

8 Q. Did you play with anybody else at that time during this
9 first occasion that you saw the game?

10 A. Yes. I played with a graduate student who was there.

11 Q. Do you know his name? A. No, I don't. It was
12 his baby, the graduate student's. He was kind of a custodian,
13 I think, of that particular Space War game.

14 Q. What do you mean by the term custodian? 2 85505

15 A. I don't know. He just seemed very knowledgeable and--you
16 know, like it was not Jim's. Jim had just played it, saw it,
17 knew the guy, brought me in.

18 Q. Do you know if the graduate student was the one who wrote
19 the program? A. I had a feeling he was, though I
20 don't believe it was ever said so.

21 Q. Did the graduate student have the program in his possession
22 at the time? A. I don't know.

23 Q. Do you know what form the program was in at that time?

24 A. No, I don't.

25 Q. Was it necessary for that particular graduate student to
26 be present before somebody could play Space War at that
27 particular installation? A. I don't know.

28 Q. After this first occasion when you saw Space War shortly

1 after going to the University of Utah what was your next
2 activity with relation to the apparatus for playing games using
3 a cathode-ray tube display?

4 A. Well, it was about, oh, somewhere around a year later and
5 one of my fraternity brothers got involved in the computer
6 center a little bit more and introduced me to several of the
7 people and we got talking about the games and I thought it would be
8 kind of fun to learn how to program games.

9 Q. You say this was approximately a year after you saw the
10 Space War game for the first time? A. Yes.

11 Q. Did you see any Space War games between the first time that
12 you saw it and the time approximately a year later when your
13 fraternity brother got involved in the computer center?

14 A. No, I didn't.

2 85506

15 Q. What did you do as a result of your thinking that it would
16 be fun to program games?

17 A. Well, I asked for a listing of the current Space War game,
18 I think I wanted to understand how they had done what they had
19 done, you know, and made some modifications.

20 Q. Who did you ask for this?

21 A. Randall Willey.

22 Q. Who was Randall Willey? A. He's the fraternity
23 brother.

24 MR. HERBERT: How do you spell Willey?

25 THE WITNESS: W-i-l-l-e-y, I think.

26 MR. WILLIAMS: Q. Do you know where Mr. Willey is located
27 presently? A. I think he's in New York or

28 Washington. He works for the Navy in their computer operations.

1 Q. You mean in New York City?

2 A. I'm not sure. I haven't really kept in touch with him.

3 Q. When was the last time you saw Mr. Willey?

4 A. I think when I left Salt Lake is the last time I saw him.

5 Q. What Fraternity were you and Mr. Willey in, do you remember?

6 A. I was a Pi Kappa Alpha.

7 Q. Does the Pi Kappa Alpha have a national headquarters?

8 A. Yes. It's in the south somewhere. We were supposed to
9 know that as pledges. I don't remember. I think it's in
10 Virginia.

11 Q. Do you get any kind of directory of the membership in
12 Pi Kappa Alpha? A. No, I don't.

13 Q. Do you have any kind of directory of that fraternity?

14 A. No.

2 85507

15 Q. Do you know if one exists?

16 A. I think probably
17 they do. You know, I get letters from them occasionally putting
18 the bite on me for some money, which I think is the main function
19 of alumni.

20 Q. You said you asked Mr. Willey for a listing of the current
21 Space War games. Did he give you such a listing?

22 A. He told me where I could get one. He directed me to a guy
23 and he gave me a listing.

24 Q. Who was the guy? A. I don't remember.

25 Q. In what form was the listing when you received it?

26 A. It was a printout.

27 Q. Was it in the English language? A. Oh, no. It was
28 in Fortran.

Q. At the time you received this printout, what prior

1 experience had you had with computers?

2 A. I had had a couple of classes. I think I had had EE-75 and
3 EE-175 at the time which was an electrical engineering program-
4 ning class.

5 Q. By classes do you mean courses ~~covered in~~ that periodical?

6 A. Yes. There were also engineering-related or computer-
7 related problems in some of the other classes.

8 Q. Do you recall what the subject matter of EE-75 was?

9 A. It was introduction Fortran.

10 Q. Any particular version of Fortran?

11 A. I don't remember.

12 Q. What was the subject matter of EE-175? 2 85508

13 A. It was an upper--you know, it was continuing course. I
14 think it's Fortran and I think we got into a little bit of
15 Algol. The listing may have been in Algol. I'm not sure. If
16 I could pin the time, because I obviously didn't know how to
17 read Algol before then. But it was in a computer language. I
18 think it was Fortran.

19 Q. You didn't know how to read Algol before when?

20 A. Before EE-175. I think it's EE-175. It's the later-on
21 computer language.

22 Q. So you think that you received the computer listing after
23 you had completed the EE-175 course?

24 A. I just don't know.

25 Q. But you had at least completed the EE-75 course?

26 A. Oh, yes. You play in that country, you have to know the
27 language.

28 Q. What did you do with the listing after you received it?

1 Space War program as we talked about?

2 A. I personally really didn't do that much. It was a very
3 complex program. It was, quite frankly, a little bit better
4 than--you know, it took a little better capability than I had
5 at the time.

6 Q. This was the Space War program? A. Yes, Space War,
7 and there were some other--you know, it was primarily the
8 modifications of Space War but there were some other things
9 that--we took out gravity and tried a flying game, you know,
10 in which the thing was more like a jet. That wasn't quite as
11 much fun as Space War.

12 Q. I guess I don't understand what the flying game was all
13 about. A. Well, in the Space Wars you always
14 had free fall so that you could point in the opposite direction
15 than you were traveling and then if you pushed the thrust button
16 it would slow you and pretty soon you would move back in a
17 different direction. 2 85311

18 If you're taking the flying algorithm, then you're moving
19 in a direction wherever you are pointing. But that's a very
20 simple modification to the program.

21 Q. Did you do anything else to the program during that work?

22 A. I don't really remember which things we played there and
23 which things I played later than that. I know that I can
24 remember the first things that I did--you know, it was not
25 really any big deal at that time. It was just a lot of fun
26 to do and it took a certain amount of dedication to get up at
27 2 in the morning to go in and get some free computer time. So
28 it wasn't one of those things you did a whole lot.

1 Q. But all the activities during that quarter were on the
2 Univac or the IBM 7094? A. Right.

3 Q. With the same displays we have testified about previously?

4 A. Right. We did a lot of things with just playing around
5 with the computer in terms of I can remember we did some really
6 interesting designs, just making designs on the screen, you
7 know. You put in a polar coordinate equation and trace it out
8 and you'd make some pretty designs. There was an interesting
9 one that we did in which they had a round ball, they called it
10 a mouse. You could program in so that you could rotate a cube
11 in any direction and try some of those modifications. But
12 they were very--you know, they were more toys really or using
13 it as a very expensive sketch.

14 Q. It was not a game as such?

2 85512

15 A. No. I mean, we did games, but we also just did other
16 things having to do with the computer itself.

17 Q. Following that quarter which you were testifying about,
18 what was your next activity relating to the--

19 A. It would have to be at the Artificial Intelligence Labora-
20 tory at Stanford after I came to California.

21 Q. When was that? A. It probably was in middle '69.

22 Q. What was your first activity relating to the playing of
23 games at the AI Lab? A. Oh, Space War.

24 Q. It was Space War? A. Right.

25 Q. What kind of machine was Space War played on at the AI Lab?

26 A. I think it was a PDP-6 or PDP-10. That was on an XY display.

27 Q. While you were at the University of Utah did you record any
28 of the work that you did relating to the playing of games on a

1 written down the titles of the papers of the people.

2 Q. I gather you have ordered a copy of the transcript from
3 the University of Utah? A. Yes.

4 Q. And you have corresponded with Dr. Atwood to try and get a
5 description of the course?

6 A. I have been attempting to get ahold of Dr. Atwood, but he
7 is not full-time at the University any more. It's been a
8 little tough getting ahold of him.

9 Q. Do you have any idea when you expect the transcript to
10 arrive? A. I think any day now.

11 Q. As best you can recall at the present when did you take the
12 Senior Thesis course?

13 A. I think it was the spring of '67.

14 Q. Can you describe in a little bit more detail what was
15 included in that paper? You said it was a block diagram.

16 Can you reproduce the block diagram? 2 85515

17 A. Sure. These are monitors and then I had controls feeding
18 back to the computer. I mean, it was not a technical exercise.
19 It was more of a writing exercise.

20 Q. Was that the only diagram that was included in the paper?

21 A. I think so. It wasn't a very long diagram. Or, I mean,
22 it wasn't very long a paper. I think that's the only picture
23 that was there.

24 Q. Did the paper say anything about what would be contained
25 in the box which you have labeled on the diagram you just drew
26 as "computer"?

27 A. Computer? It was a general-
28 purpose time-sharing type computer. I will have to admit this
is very foggy recollections on some of this.

1 Q. You have drawn six small boxes connected by lines to two
2 parallel lines and I gather that you have meant to indicate
3 that each one of those six small boxes--

4 A. Was a monitor.

5 Q. What do you mean by the word monitor?

6 A. What do I mean now or what did I mean then?

7 Q. What did you mean then? A. I think I just meant
8 the type of display that I was familiar with at the school.

9 Q. You mean an XY type display?

10 A. I don't know what that was.

11 Q. You mean the type of display used in conjunction with the
12 Univac or the IBM 7094 that you were working with?

13 A. Yes. Let me take that back. I don't really know what
14 kind--you know, it was just a monitor that you could play
15 games on for an amusement park. 2 85516

16 Q. Did the paper include any description of the types of games
17 that might be played on it? A. Yes, it did.

18 Q. What kind of games were described?

19 A. Space War.

20 Q. The Space War similar to the Space War which you played on
21 the computer-- A. Yes. Hangman, which is a

22 word game. The question and answer game, you know, which
23 question will flash up and you had a multiple choice answer.
24 A baseball game.

25 Q. Any other games? A. I think those were the only
26 three that I described.

27 Q. Would you describe what the baseball game was, how you
28 intended it to be played?

1 A. I intended it to be played similar to the machines that I
2 was operating at the time in which there was a ball and a bat
3 and you were to attempt to hit targets.

4 Q. How would the ball appear at the plate?

5 A. I didn't go into that.

6 Q. Did you describe in the paper the game baseball in greater
7 detail?

8 A. I just said a game that simulates
9 the game of baseball in which a ball is pitched to a batter and
10 the batter is controlled by the player. The attempt is to hit
11 the ball straight back to get a home run. If you deviate from
12 the center, then you can get anywhere from a single run to an
13 out. Three outs--and it was a dime in those days. Three outs
and you had to put another dime in to play. 2 85517

14 Q. Did you state in the paper whether you expected that there
15 be a symbol on the screen which a player could maneuver somehow?

16 A. Well, I mean, if you're going to have a ball on the screen
17 I suppose that would be a symbol. I don't think I used that
18 verbiage.

19 Q. Was the bat to be moved on the screen?

20 A. Obviously.

21 Q. How was that to be done? A. By pushing a button.

22 Q. What would occur when one pushed the button?

23 A. The bat would swing.

24 Q. Was this described in the paper?

25 A. I really don't remember. I just remember that I described
26 a video version of the games that were around at that time.

27 Q. Did anybody else besides you and Dr. Atwood and your wife
28 see the paper? A. I really don't know.

1 Q. Do you think other persons might have seen the paper?
2 A. I think it's possible. If I knew who they were I would
3 know by now. I mean, I would have talked to them by now.
4 Q. So you have searched for other people or attempted to
5 recollect who they might be?
6 A. I have tried to get some corroboration on that, yes.
7 Q. Have you talked to your wife concerning whether she
8 remembers the contents of that paper?
9 A. Oh, yes, obviously.
10 Q. Obviously yes? A. Yes.
11 Q. Does she remember what was in that paper?
12 A. Not in great detail. 2 85518
13 Q. Does she remember the description of the game baseball?
14 A. No.
15 Q. Did you ask her if she read the description of the game
16 baseball? A. No, I didn't.
17 Q. What is your wife's present residence?
18 A. 3572 Gibson, Santa Clara.
19 Q. What is her name? A. Paula Rushnell.
20 Q. I assume that you and your wife are divorced?
21 A. Yes, we are. I'm not sure if that means you've got a
22 friendly witness or not.
23 Q. How many monitors did you contemplate could be attached to
24 a single computer for the playing of games?
25 A. I thought six was--the speeds and the kinds of information
26 at that time.
27 Q. Did you have any thoughts as to what the capacity of the
28 computer would have to be to play six games?

1 A. It had to do an awful lot with how much refresh you had to
2 do, so it meant how smart the computer was. Or the terminal,
3 I should say.

4 Q. Did you do any calculations to figure out what the correla-
5 tion might be between the capacity of the computer and, as you
6 put it, how smart the monitor was in order to get an acceptable
7 apparatus?

8 A. No. I think I just wet my finger--you know, I was trying
9 to get the paper out and I didn't care about technical
10 excellence because I knew I was going to get graded on
11 punctuation. The nice thing about schools is that you don't
12 have to build anything that you design. 2 85519

13 Q. Did you ever build an apparatus as it was shown in the
14 paper?

15 A. I attempted to later on. I mean, a time-
16 sharing system.

17 Q. When did you attempt it or when did you first start to
18 attempt it?

19 A. It was I'd say the middle of 1970
20 or early 1970.

21 Q. Did you complete building the apparatus as described in the
22 paper?

23 A. No, I didn't. I just got to a paper
24 design.

25 Q. Is there any particular reason why you stopped working?

26 A. Yes. I found a better way.

27 Q. What way was that?

28 A. Well, in the using of
a computer and a monitor, the calculations you were talking
about, I kept going through them finding that I was running out
of time doing the kinds of things on the six monitors that I
wanted to. So then I cut it back to four monitors and in doing

2 85520

1 more interface and more software I found that I was again
2 running out of time. Since I decided that we had to design the
3 monitor because the terminals at that time were very expensive,
4 I was building my own monitor, a special-purpose terminal for
5 this thing. Each time I would find in the computer that I was
6 running out of time I'd take some of the functions out of the
7 computer and put it into a slightly more intelligent terminal.
8 After I went through the loop two or three times and each time
9 finding conditions in which the computer would run out of time,
10 I took a look at the terminals and said, "Gee, they're getting
11 so smart, why do I really need that? Let's throw away the
12 mini-computer and put it all in the terminal." That's really
13 how the stand-alone games evolved. I was really happy because
14 it made a lot more economic sense, you know, once you can split
15 them apart so that your stand-alone units, limiting your market
16 to the large amusement parks, you know, that would have to take
17 the six or seven terminals to make it justifiable economically.

3 Q. As far as you know was it ever actually done in 1969 that
4 the games were played on a raster scan display setup?

5 A. To the best of my knowledge, no, they weren't.

6 Q. I believe you stated that in early 1970 you attempted to
7 build an apparatus for playing games similar to the one
8 described in the paper which you wrote at the University of
9 Utah? A. Right. 2 85521

10 Q. Prior to that did you do anything to attempt to construct
11 or interest anybody else in constructing the apparatus as
12 described in that paper? A. No, I didn't.

13 Q. Did you ever show the paper to anybody at Lagoon Corpora-
14 tion or Amusement Services Corporation?

15 A. No. I think I talked to some of the people at Lagoon saying,
16 you know, "Gentlemen, it would be neat if we could have a com-
17 puter out here and hook it up." But, you know, it was one of
18 those things where when you're talking about six games that
19 would cost as much as the roller coaster, it was kind of an
20 academic kind of discussion.

21 Q. How much do you think six games would have cost at that
22 time? A. Using that system probably a

23 quarter of a million dollars.

24 Q. At that time would that have been an economic investment as
25 far as you know to get six games?

26 A. I don't know. The question then becomes if you had six of
27 them--well, let's put a pencil to it. If you could get fifty
28 cents a game and it plays in two minutes, that would be \$15 an

1 hour times six, that would be \$90 an hour. If you amortized
2 the thing over three years, what does it come out to? Say
3 that you want a ten-percent return on your capital. A quarter
4 of a million dollars and a ten-percent return. If you have two
5 years which is 24 months--this says that you would have to make
6 \$11,000 a month. \$11,000 a month at \$90 an hour, let's divide
7 24 into that. That is \$490 a day. So that says that you
8 could just barely make it if you could keep the machine going
9 full tilt for five hours a day or six hours a day, rather. So
10 it was marginally doable based on some good assumptions.

11 Q. At that time was fifty cents a game a realistic price?

12 A. Well, I'm saying that games were really great. The market
13 at that time was 25 cents. So it says that you would have to
14 keep the game going for 10 or 12 hours. I don't think I would
15 invest my money in it. 2 85522

16 Q. Do you have any documents relating to your attempts to
17 build the system of your paper in early 1970?

18 A. Yes, we do. They are right here (indicating).

19 Q. You have pointed out two files, one labeled "Data General"
20 and the other one labeled "System Planning, Nova Interface."

21 A. Right.

22 Q. And those are the only two files?

23 A. That's all that I could find. They were down in the bottom
24 of a box of all kinds of junk.

25 MR. WILLIAMS: I would like to have the Reporter mark as
26 Atari Exhibit 39 a manila file bearing the label "Data General,"
27 and as Atari Exhibit 40 a manila file bearing the legend
28 "System Planning, Nova Interface."

1 I think maybe, Mr. Reporter, if you could mark each paper
2 in each one of these files as in the case of Exhibit 39, 39-1
3 through 39 whatever it takes, and likewise with Exhibit 40.

4 (File folder labeled "Data General"
5 was marked Atari Exhibit 39-1
6 through 39-7 for Identification.)

7 (File folder labeled "Legend
8 System Planning, Nova Interface"
9 was marked Atari Exhibit 40-1
10 through 40-18 for Identification.)

11 MR. WILLIAMS: Q. Mr. Bushnell, I hand you Atari Exhibit
12 39 and the document which has been marked 39-1 and ask if you
13 can identify that document for me.

14 A. Yes.

15 Q. What is it? A. It's a letter that I was
16 going to-- No. It's an envelope. It's a letter in which--

17 Q. You are referring to 39-2 as the letter?

18 A. Yes. 39-1 is an envelope. --in which we were going to
19 order a Lata General computer. 2 85523

20 Q. You say, "We were going to order a Data General computer"?

21 A. The company. The Syzygy Company at that time.

22 Q. And Syzygy at that time was a partnership; is that correct?

23 A. Yes.

24 Q. Consisting of you and Mr. Dabney? A. Right.

25 Q. How did this relate to your infiltration of the system of
26 your prior paper? A. Well, we had gotten to a

27 point where we felt that we had feasibility on the system and
28 so we needed a machine to actually build one.

Q. The letter-- A. Well, what it was, we wanted
to get the best price we could so we ordered six of everything

1 except for one item which I guess we needed more than that.
2 Because we didn't have any money. So we wanted to, you know,
3 give the impression at least that we were high rollers.

4 Q. Was that letter ever sent? A. No, it wasn't.

5 Q. It appears to bear the date January 26, 1971.

6 A. Correct.

7 Q. Was it written on or about that date?

8 A. Yes, it was.

2 85524

9 Q. Prior to the time of writing that letter had you built any
10 devices for the playing of games using a cathode-ray tube
11 according to your system of your prior paper?

12 A. Yes. We had put some stuff together as far as a monitor
13 goes. See, with this system we were building terminals to hook
14 on which this would drive and we had established at that point
15 that we could get a tube hooked up to a raster scan responding
16 to that and I think we moved some objects around.

17 Q. Well, on January 26th of 1971, you were considering using
18 a raster scan display on your system? A. Yes.

19 Q. You say you put a monitor together prior to that
20 January 26th, 1971 date. Was the monitor as you had built it
21 useful for playing games?

22 A. Well, the way we had done it it possibly could have been
23 We were trying to build--Spacewar was the game that we were
24 trying, and Spacewar needed some very complex calculations and
25 the device that we lashed up didn't have the ability to do com-
26 plex calculations. It was more of a display device.

27 Q. You say it could have been used for playing games, but was
28 it used for playing games prior to that January 26, 1971 date?

1 A. Well, if you mean we moved objects around on it and had a
2 little bit of fun, yes, we did. It goes into our definition of
3 what is a game. It wasn't anything that kept score or that I
4 said, "Whoopee, I beat you." But we did move objects on it.

5 Q. How did the objects that were moved appear to the partici-
6 pants?

7 A. Well, one was we had a rocket ship that
8 would move up, down, right or left. I guess before that we had
9 a square that would move up, down, right or left. Then we
10 hooked in a diode matrix and turned the square into a rocket
11 ship.

2 85525

12 Q. How did the participant effect this motion up, down, right
13 or left?

A. Flipped switches.

14 Q. Was there only one rocket ship or square as the case might
15 be on the screen at a time?

16 A. Well, at what point in time are you talking about?

17 Q. Prior to the January 26th, 1971 date.

18 A. Yes. It was just one object. Just a second, I'm going to
19 take that back. There was only one independently moving object.
20 In developing the objects you can gate them in and out and
21 there were, you know--during the first gating, you know, there
22 could have been 48 objects and then you gate it out again and
23 it turns--or I guess it would be 64 and then it goes down to 32
24 and the more gating that you do the fewer things until you
25 finally get down to just one object. But we had beaucoup
26 objects on the screen many times.

27 Q. As I understand it, even though you may have had many
28 objects on the screen at the same time, if one moved they all
moved with--

A. Correct.

1 Q. I show you a document which has been marked 39-3 and 39-4
2 and ask if you can identify those?

3 A. That's a listing that came from one of the trade journals,
4 and I don't remember which one it was, which listed all the
5 mini computers that were on the market at that time, their
6 approximate costs and how fast the cycle time was and what the
7 architecture of the machine was. It was sort of a thing that
8 we went through to see if there wasn't a cheaper system that we
9 could buy that would do essentially the same thing.

10 Q. Essentially the same thing as what? 2 85526

11 A. The same thing as the Data General unit that we felt
12 probably was as good a buy on the market at the time for what
13 we wanted.

14 Q. I notice that those two documents bear the dates August
15 1970. Were these documents that you were considering after the
16 date of January 26, 1971 or prior to that time?

17 A. Well, it was prior because, you know, obviously we had made
18 a decision at the time this letter was written as to which com-
19 puter we wanted and we had been looking at this quite a bit
20 before August 1970 and was very happy when they published this
21 because it made us evaluate a lot more units.

22 Q. You said you were looking into it quite a bit before
23 August of 1970. I gather from your prior testimony that all
24 of your activities were during the year of 1970 with respect
25 to the building of this?

26 A. That is true, in terms of actually putting any hardware
27 together or, you know, drawings.

28 Q. I will hand you Exhibit 39-5 and ask if you can identify

1 that? A. It's just basically a little further detail
2 on the Nova computer series.

3 Q. This was the computer series that you were considering
4 using in your system? A. That's correct.

5 Q. Was that the Nova 1200 as described in this exhibit?

6 A. Correct.

7 Q. I show you Exhibit 39-6 and ask you if you can identify
8 that? A. It's an OEM blanket quantity and cumulative

9 discount agreement. That was the thing that we were planning to
10 really buy a bunch of these things so we wanted to get the
11 price out of the chute that we could.

12 Q. Can you identify Exhibit 39-7? 2 85527

13 A. It's a Super Nova pricelist and it goes through the options
14 and the things that you want. It's essentially the source
15 document that allowed us to write this other letter.

16 Q. That is Document 39-2? A. Right.

17 Q. 39-2 appears to include a list of various components and
18 associated prices. I wonder if you might go through this list
19 and tell us which each one of the items identified by a number
20 is, such as 8101, 8102, et cetera.

21 A. It's been a long time. I would just have to go through
22 these things. They are essentially parts to a mini computer.

23 Q. So far as you know the identifications given in 39-7 of the
24 various type numbers I believe are the same type numbers
25 referred to in 39-2? A. Right, yes.

26 Q. Is the description given in Document 39-7 of each of those
27 type numbers accurately reflective of the description of the
28 items listed in the letter of 39-2?

1 A. I think so, unless we made a mistake.

2 MR. HERBERT: I object. I don't think there is any
3 description of an item on 39-2, nothing more than a type
4 number.

5 THE WITNESS: But the description is in here.

6 MR. WILLIAMS: Q. Do the descriptions of the type numbers
7 shown in Document 39-7 accurately describe the units listed in
8 39-2? A. Yes.

9 Q. Are the prices shown in 39-2 opposite the corresponding
10 units a unit price?

11 A. I think that was an OEM discount based on the quantity,
12 discount price.

13 Q. That was the price you expected to pay for the units if you
14 had actually purchased them from Data General at the time?

15 A. Right. 2 85528

16 Q. So that, for example, one 8101 would have been \$1,617?

17 A. Right.

18 Q. At the time of the preparation of the letter 39-2 did you
19 have an estimate of what the cost per game would be in the
20 system you were constructing? A. Yes.

21 Q. Do you know what that estimate was?

22 A. I think it was around \$1,000.

23 Q. At that time were you considering using six games on each
24 system? A. It was either six or eight. I think

25 I started out with eight and then backed into six as I started
26 running out of time on the computer.

27 Q. Did you ever order any computers from Data General for
28 this system? A. No, I didn't.

1 Q. Did you order computers from anybody else for this system?

2 A. No, I didn't.

3 Q. Did you ever complete building this system?

4 A. No, I didn't.

2 85520

5 Q. I hand you Atari Exhibit 40 and ask you if you can identify
6 Document 40-1?

A. This is a letter from
7 Bob Washburn who was the sales engineer in the area for Data
8 General. We had kind of been stringing him along because we
9 weren't ready to commit the dollars and we had sort of told
10 him, "Yes, the order is coming. The order is coming." I think
11 this letter is to just sort of jack us up and trying to push
12 us into a close. It was during this period that I had pretty
13 much decided that I was not going to go the direct computer
14 route but was going to go to a single stand-alone unit.

15 Q. During what period was this that you just referred to?

16 A. Between the time of composing that letter to the time that
17 I got that. Because it was--I was almost ready to go but I
18 just wanted to go back and check to make sure that the system
19 as I had configured it made sense. I wanted to make sure the
20 thing was doable, and so I wanted to get closer-- I had found
21 a place where I could rent a Data General computer and I had
22 gotten a little bit closer to a guy that was there who was
23 trying to sell me some time on the machine. He pointed out some
24 thing that I had failed to take into consideration on my initial
25 calculations and it scared me into thinking that maybe I wasn't
26 even going to be able to get four monitors to go. So at that
27 point I decided that I really needed to change one of my designs
28 at that time and that pushed me into the thinking of just doing

1 it all hardware and not doing it software with the computer.

2 Q. And the period during which this occurred that you are
3 referring to was the period between the dates of 39-2 and 40-1?

4 A. Right. 2 85530

5 Q. What was the date on 40-1? A. February 16, 1971.

6 Q. I show you a document 40-2 and ask if you can identify
7 that, please. A. This was the interface unit

8 that took the data from the computer and displayed it on the
9 TV screen, part of the interface unit.

10 Q. Was that part of the monitor which you were considering?

11 A. Right.

12 Q. Was that apparatus ever built?

13 A. No, it wasn't. Well, parts of it were. This part was
14 never built (indicating).

15 Q. Which part is that? A. That is 40-7.

16 Q. What is shown on 40-7?

17 A. This was basically the part that made the monitor talk to
18 the computer.

19 Q. Was there a name for that part?

20 A. I didn't put it on. I think I always called that the inter-
21 face card. This other one would probably be called the address
22 card.

23 Q. What document are you referring to?

24 A. Oh. 40-2.

25 MR. HERBERT: It would be called what?

26 THE WITNESS: The address card. I'll be darned if I know
27 what 40-3 is. I would have to think about it for a minute.

28 MR. WILLIAMS: Q. Is 40-3 another diagram associated with

1 the monitor or a diagram of a portion of the monitor?

2 A. Yes. All of these have to do with the monitor.

3 Q. By "all of these" you are including--

4 A. 40-6, 40-8, 40-10, 40-11, 40-14, 40-15, 40-17. Portions
5 that were built were the sync generator and the--

6 Q. Do you know which diagram the sync generator is?

7 A. I'm not sure. Frankly, I don't see the sync generator
8 diagram here. I think the only reason that we have these
9 documents are these are the parts that ended up not being used
10 in the ultimate system and the other stuff got reworked and
11 used and ultimately in the filing system and where they are
12 heaven only knows. I was actually surprised I even found these
13 things.

14 Q. By "the ultimate system" you mean the stand-alone games?

15 A. Right.

16 Q. Do you think that the drawings that were reworked into the
17 stand-alone game still exist? 2 85531

18 A. I just have no way of speculating on that.

19 Q. Did you look for them? A. Yes, I have.

20 MR. HERBERT: These are among the things that I have asked
21 Mr. Bushnell's secretary to go through and try to find and she
22 has indicated that for all of the games there may be the files
23 of 20 different engineers. She is going to try to get the
24 beginning ones for those two games tomorrow and try to zero in
25 on this particular one after that.

26 MR. WILLIAMS: Q. You started saying that you had built
27 the sync generator? A. Yes.

28 Q. Which other portions did you build?

1 A. Some motion circuits and a scanning matrix, video amplifier.

2 Q. What was the purpose of the sync generator?

3 A. Well, to get the scans going. You have to have a frame of
4 reference.

5 Q. This was to generate the scan for the cathode-ray tube dis-
6 play? A. Right.

7 Q. What was the purpose of the motion circuits?

8 A. To put the objects on the screen and move them around.
9 Actually, the motion circuits that we used at that time were
10 more exercisers to take the place of the computer because the
11 way we had it was that the computer would put out an address
12 word that would tell the monitor where to display the object
13 and by putting in counters you could simulate that address word
14 and move objects around the screen. That turned out to be the
15 essence of the way it was, instead of being an exerciser
16 ultimately taking the place of the computer it replaced the
17 computer.

18 Did I make sense on that? 2 85532

19 Q. What do you mean by the term exerciser?

20 A. Well, to get your hardware working a lot of times you need
21 a very predictable signal so that you know that your hardware
22 is working so that if you get information out of the computer
23 you can make sure that it's not--you know, you have a problem
24 sometimes whether it's the computer that's fouling up or
25 whether it's your hardware. So you develop a little very simple
26 computer, you would say, which we call an exerciser which would
27 essentially be partitioned outside of the system, but to the
28 system would look like a computer but without all the bells and

1 whistles as far as the capability that the computer would have.

2 Q. Was an exerciser to be used with the monitor when the
3 monitor was attached to the computer as you intended in your
4 system?

5 A. Initially, no. The exerciser would
6 be taken off and the computer would be hooked where the
exerciser was.

7 Q. But at some later time it was to be used with the monitor
8 as it was attached to the computer?

9 A. When I decided to not go with the computer system the
10 exerciser was modified so that it did more things. What
11 essentially happened is I made a very sophisticated exerciser
12 which ended up playing the whole game instead of the computer
13 doing it.

14 Q. What was the purpose of the scanning matrix circuit?

15 A. It's relatively easy to just put square blobs on the
16 screen. The matrix was to turn the blob into a rocket ship.

17 Q. That was the diode matrix? A. Correct.

18 Q. What was the purpose of the video amplifier?

19 A. To make it talk to the television set at levels it could
20 see.

2 85533

21 Q. To make what? A. The signal, the output of
22 the computer.

23 MR. WILLIAMS: Let's take a brief recess.

24 (Short recess.)

25 MR. WILLIAMS: Q. Mr. Bushnell, as I understand it,
26 Documents 40-2, 40-3, 40-6, 40-7, 40-10, 40-11, 40-15 and 40-17
27 all relate to circuitry which you intended to use with the
28 monitor in association with your system for playing games?

1 A. Correct.

2 Q. But that there is, as I understand it, circuitry which you
3 had also intended to use for that monitor which is not shown in
4 any of these documents? A. That's correct.

5 Q. Did you personally draw the diagrams of 40-2, 40-3, 40-6,
6 40-7, 40-10, 40-11, 40-14? A. Yes, I did.

7 MR. HERBERT: Before you start questioning on that, prior
8 to the recess I had indicated that we would, after finding the
9 pre-production drawings for Pong and another game, Space Race,
10 zero in on the earlier drawings on this to match up with what
11 else goes here.

12 During that recess Mr. Bushnell told me that very probably
13 all of the drawings that are missing from this package were
14 left at Nutting. So we don't really expect to find them.

15 MR. WILLIAMS: Q. Do you believe that the drawings missing
16 from Exhibit 40 relating to your monitor are at Nutting?

17 A. Yes, I do.

18 Q. Why were they left at Nutting?

2 85534

19 A. Well, they were all essentially source documents which were
20 later used to build the Computer Space machine which I sold to
21 Nutting and since I had licensed them to build that machine
22 exclusively they are obviously entitled to all the documents
23 that have to do with that particular machine.

24 Q. Do you know when you drew these documents which I just
25 enumerated?

26 A. I'd say it was probably around July
27 or August 1970. It might have been as early as February for
28 some of them, but I think the ones that I drew in February were
rougher. These are more detailed as to interconnections.

1 Q. Since only a portion of the circuit of the monitor is shown
2 on these drawings, it might help us if you could draw a block
3 diagram of the operation of that monitor if you are able to do
4 so? A. Okay.

5 Q. And I might say that we will probably mark it as an exhibit.
6 You will be forewarned.

7 MR. WELSH: Now, this is of the monitor system?

8 MR. WILLIAMS: Q. Yes.

9 A. Incidentally, this is generalized terminology for data bus
10 architecture. I am indicating there are several lines. The
11 exact number of lines depends on the resolution that you wish.
12 This is approximately it with some simplifications.

13 MR. WILLIAMS: I would like the Reporter to mark the block
14 diagram that Mr. Bushnell has just drawn as Atari Exhibit 41.

15 (Drawing made by the witness was
16 marked Atari Exhibit No. 41 for
Identification.)

17 MR. WILLIAMS: Q. Mr. Bushnell, will you just give us a
18 description of the operation of this system shown in Atari
19 Exhibit 41? 2 85535

20 A. The oscillator runs a sync chain which essentially counts
21 down the oscillator frequency into a horizontal and vertical
22 component. There's a number associated with each picture
23 element in both the horizontal and a number coincident with
24 each line in the vertical direction. These numbers are fed
25 into a compare circuit which is compared to a number which is
26 in the shift register. If you can visualize a television
27 screen, zero zero being in the upper left-hand corner and
28 256 by 256, the number 256 by 256 is the number in the lower

1 right-hand corner. Then you can see that there is a series of
2 ordered pairs which describe every point on the TV screen.

3 Everyone follow that?

4 Q. I follow it.

5 A. The sync chain will count
6 every one of those numbers in one frame. So that first the
7 vertical counter is at zero and the horizontal counter then
8 counts up to 256 at which time it gives the TV screen a sync
9 pulse and the scan is reset and now the vertical scan counts to
10 1 and again to 256, and then the vertical goes to 2, 3 until
11 it's scanned the whole time.

12 Now, supposing that we wish to display an object at point
13 20/20. That would be one inch to the right and one inch down
14 from the upper left-hand corner. We would then put the number
15 20/20 into the shift register. Upon 20 being compared--

16 Q. Excuse me. You mean load 20 into the shift register under
17 the block marked "Sync H"? **2 85536**

18 A. Yes, and 20 into the shift register under the block
19 "sync V." This comparator, all it does is look for a comparison.
20 It says when is one number equal to another. As soon as it
21 does, it goes, "Hi," turns on the scanning matrix. The scanning
22 matrix then says, "Okay, I'm ready to scan," and it counts--I
23 should say it is hooked into the oscillator or to the sync H
24 and V.

25 We'll just for ease put the oscillator here (indicating).

26 It says, "Okay, I'll display a rocket ship at that point,"
27 and it counts through and displays a rocket ship at Point 20/20.

28 Now, what the comparator does is it feeds that number 20
into the shift register. Now, next frame it says, "Okay, I want

1 the rocket ship to move downward and to the right." So next
2 frame it will load into it number 21/21. The same thing happens.
3 This time, though, the rocket ship is moved slightly. It's no
4 longer displayed at 20/20, it's at 21/21. And successively
5 each frame. So in that way the rocket ship appears to be
6 traveling in a downward and to the right velocity because the
7 eye integrates the motion. It's just like a series of cartoons
8 and you display it at slightly different places each time and
9 the picture appears to move. 2 85537

10 Now, the computer, of course, is keeping track of one, if
11 the control is being pushed, say, in the forward direction and
12 it's thrusting it's saying, "Okay, if I want the rocket ship to
13 go faster I'm going to say instead of moving it from 20 to 21
14 I might move it from 20 to 22. That gives the appearance of
15 a faster motion. Or if it wants to move slower maybe it says,
16 "I'll keep it at 20 for a couple of frames and then I'll move
17 it to 21 for another couple of frames and then to 22 for
18 another couple of frames." So it's going half as fast.

19 If you wanted it to go straight up and down all you are
20 doing is you leave the horizontal counter fixed at 20 and you
21 just increment or decrement the vertical count and the computer
22 keeps track of all these numbers and feeds a new number out
23 each frame which places the rocket ship anywhere.

24 Now, obviously if you wanted to, you could make the object
25 jump anywhere you want to once each frame. But generally by
26 making a piecewise continuous function you can have the
27 appearance of smooth motion, but it's not constrained to do
28 that.

1 Q. The computer which you refer to is not shown in Exhibit 41,
2 as I understand it.

3 A. No. It's a data bus here. It's out here (indicating).
4 It comes in on the bus. I should have put that down, "data
5 bus."

6 Q. There are two boxes in the lower left-hand corner. What
7 does the label on the upper one of those two boxes say?

8 A. "Interface." It's essentially the part of the circuit
9 that's described in 40-7.

10 Q. And the lower box in the lower left-hand corner is labeled
11 "IO." Is that correct? 2 85538

12 A. Yes. That's essentially the problem that we were talking
13 about before. Whether you do that on an interrupt basis, or
14 whether you do it just putting data into memory. Now, you can
15 do it either way. That IO is either a direct memory access
16 channel or it's an interrupt channel.

17 Q. So the player's controls are located within the box marked
18 "control"? A. No. These are control switches
19 and coin slot.

20 Q. Over on the lower right-hand corner? A. Right.

21 Q. And that information goes through the box marked "control"
22 to the box marked "IO"? A. Yes. Input-output.

23 Q. So the box marked "IO" was actually only an output channel,
24 is that right, the way you have drawn it?

25 A. In a computer there is never really an output without an
26 input because there's parity checks. It talks. You send sig-
27 nals in two directions and for a multitude of reasons, but it
28 essentially can be looked at, it says, "Hey, I've got some

1 information."

2 The computer says, "Okay, I'm ready for the information.
3 Go ahead and send it." So it sends it down. The computer
4 says, "Okay, I've got it."

5 And the guy says, "Is it right?"

6 And the computer says, "Yes, it was." And they do these
7 handshaking things all the time. It's just the way the archi-
8 tecture is.

9 Q. But the basic purpose of the IO block is to get information
10 from the monitor to the computer, as I understand it.

11 A. Yes.

12 Q. You described the way in which one rocket ship is shown
13 during one scan of the cathode-ray tube.

14 A. Right.

2 85539

15 Q. In the system you were building in playing Spacewar I
16 assume that you wanted to show at least two rocket ships.

17 A. Yes. That adds a whole new level of complexity. That's
18 kind of what this is. Because these are shift registers. I
19 have two sets of shift registers, one labeled A and one
20 labeled B. I am referring to Document 40-2. It's necessary
21 that you have two data boards, one the location of rocket ship
22 A and one the location of rocket ship B, and under the control
23 you can switch from one to the other.

24 Q. What does the circuitry shown in Exhibit 41 provide? What
25 is necessary to display two rocket ships?

26 A. Well, it depends on how much intelligence you ascribe to
27 the control module. Like it's possible that the control
28 module or the computer is smart enough to serially order the

1 information in shift registers, in these two shift registers,
2 so that it always hits the first shift register of the first
3 object in the scanning sequence, and then the minute it sees
4 that then it dumps that information out, grabs another piece
5 of data from the computer and says, "Okay, this is rocket ship
6 No. 2." That could do it. But I think that 40-2 is a better
7 approach. It's a little bit cleaner. 2 85540

8 Well, this is again the problem that I ran into. If you
9 do it this way the computer has to be very smart and it has to
10 be fast because it has to have that information ready for the
11 second rocket ship very, very quickly because the minute the
12 one rocket ship is done, if the other rocket ship is very close
13 to it it has to have that information in a big hurry or you're
14 going to lose it, the rocket ship will disappear if it gets
15 close. So what you can do is you can say, "Okay, I'm going to
16 make the monitor smarter and I'll just dump the information
17 out at one time," say during frame scan or frame reset in
18 which there's a lot of time, and that way the computer doesn't
19 have to be as smart. This design was an afterthought of this
20 kind of an architecture.

21 Q. You are saying that the document of 40-2 is an after-
22 thought to the architecture shown in 41?

23 A. Yes. I want to keep this simple so that you can understand
24 it. You see, the more and more smarter I made the monitor, the
25 less power I had to have in the computer itself until finally
26 I said, "The hell with it," you know, "let's just build the
27 hardware unit."

28 Q. And the computer system which you intended to use with the

1 apparatus you have shown in block diagram form in Exhibit 41 was
2 the Nova 1200 series computer; is that correct?

3 A. That is ultimately. I think this was a general-purpose
4 design. I'm not sure which one this was, how late it was. But
5 I originally designed the general purposely so that it could
6 adapt to essentially any 16-bit machine.

7 Q. Did you have any requirements on the memory capacity of
8 a 16-bit machine with which this could be used?

9 A. Yes. As small as possible.

2 85541

10 Q. What memory capacity was required for a game system using,
11 for example, four monitors?

12 A. I felt that in my original thinking I thought that I could
13 get by with four K.

14 Q. For four monitors?

A. Yes. And memory was
15 never the problem in the design. It was always update speeds.

16 Q. Can you identify Exhibit 46-15?

17 A. Yes. It says, "System Input, one coin box to initialize
18 particular CRT and program." I think at that time we were talk-
19 ing about having it be a situation where you could not only
20 choose whether you wanted to play Spacewar, but whether you
21 wanted to play any other game that we had in the program. That
22 was kind of a question of memory. We thought that it would
23 be interesting to have the switch selectable so that you could
24 play a multitude of games. So that was No. 1 as far as system
25 input.

26 "No. 2, counterclockwise rotator input on fixed-time
27 increment and rotate counterclockwise one unit. Unit equals
28 question mark degrees." I don't know.

1 No. 3 says, "Clockwise rotator SFF2."

2 No. 4 is, "Accelerator input on fixed time increment and
3 add velocity increments to VX and VY."

4 No. 5 is, "Fire control causes missile to shoot at fixed
5 speed relative to rocket in direction rocket is pointing. Out-
6 put to CRT done by setting position, line and data. Words
7 into output area. An interrupt will be generated at end of
8 each field to indicate."

9 That's it.

10 Q. Did you write the document of 40-15?

2 85542

11 A. No, I didn't.

12 Q. Do you know who did?

A. No, I don't. I have
13 been asking myself that. It could have been a guy named Larry
14 Bryan who was going to do the software at that time.

15 Q. Do you know what the list of five items under the heading
16 "system input" is?

17 A. Well, yes. I think it's essentially all the things that
18 we wanted to put into the system, you know, to make sure that
19 we had enough input ports to play the game.

20 Q. Did Mr. Bryan generate this document 40-15 as a result of
21 a special review? A. If he, in fact, was the one
22 that generated it, and I think he was, yes.

23 Q. Do you know when it was?

24 A. It was probably during the summer.

25 Q. Of 1970? A. Yes.

26 Q. Was anybody other than Larry Bryan assisting you in the
27 construction of your apparatus?

28 A. Ted Dabney.

1 Q. What part did Ted Dabney play in the construction, in the
2 development, of that apparatus?

3 A. He was a good circuits guy. He ultimately designed most of
4 the sound circuitry and the video amplifier.

5 Larry Bryan was the software man.

6 I was the hardware man and Ted was the analog man.

7 Q. Can you identify Exhibit 40-16?

8 A. A timing diagram to a Nova 1200 computer.

9 Q. Can you identify Document 40-3?

10 A. I think it was a pin designation of input and output for
11 the interface unit to the computer. Yes, it's a pin assignment.

12 Q. Did you write the document? A. Yes, I did.

13 Any of the documents that you can't read are probably done in
14 my handwriting.

15 Q. Can you identify Document 40-13?

16 A. It's a timing diagram.

2 85543

17 Q. Is that also of the Nova 1200?

18 A. I think so. I don't really know what the difference between
19 the two documents is. One might have been for the Nova 350
20 which was a faster machine. When we started getting into
21 problems I thought I might have to go to the faster machine.

22 Q. Would you please identify Document 40-9?

23 A. It's a Xerox of a Signetics integrated circuit, and why
24 I've got it there I have no idea.

25 Oh, I know. That's an interface chip. It's the interface
26 unit. I wanted to make sure that what I was feeding to the
27 computer wasn't going to blow it up. Yes, that's what it was.

28 Q. Can you identify Document 40-5?

1 A. It looks like it's part of the technical manual for the
2 input-output bus structure for the Data General computer.

3 Q. Was that for the Nova 1200?

4 A. I believe it was.

5 Q. Can you identify Document 40-4?

6 A. Yes. That's the pin-outs of the bus connections for the
7 Nova 1200. These are all Xeroxes because before I had a chance
8 to start talking to the Nova people I was scrounging around for
9 a manual on it and there was only one in the plant that I
10 could get ahold of.

11 Q. One in which plant?

A. Ampex.

2 85544

12 Q. What do you mean by the term "pin-outs"?

13 A. Well, the bus is essentially the input port and it tells
14 what part of the computer is connected to what pin. You know,
15 like is it an input port or an output port, an address port or
16 interrupt port.

17 As an example, all I could use were the ones that were
18 vacant, you know, upon the direct memory access. These are
19 General Data bus structures.

20 See, you put input and output in terms of a word. You see
21 these data A8, A11, each one of these represents a bit in the
22 data word.

23 Q. Can you identify Document 40-13?

24 A. Yes. It's a page describing how the data channel transfers
25 work with this particular computer. It's necessary in designing
26 the thing to really have that stuff well scoped out.

27 Q. Would this particular computer be the Nova 1200?

28 A. Yes.

1 Q. Can you identify Document 40-12?

2 A. This is an OEM discount schedule which tells you what your
3 price would be depending on how many units you buy. I was
4 trying to find some way to get them to believe me that I was
5 going to take 200 units the first year so I could get a 40 per-
6 cent discount, but I didn't quite have that much guts. But I
7 was projecting that if the item did very well there would be
8 considerable savings in the computer.

9 Q. I believe your testimony is that sometime between
10 January 26, 1971 and February 16, 1971 you decided not to use
11 the central computer system? A. Correct.

12 Q. What did you do after you decided not to use the central
13 computer system? 2 85543

14 A. I put my time into designing a very inexpensive and complex
15 exerciser, if you would, that would essentially do the
16 calculations and hardware. At that time I had had a very com-
17 plex exerciser already going, but it took me quite a bit to
18 get it up to the point where it controlled two objects. It was
19 only good for one object at that point.

20 Q. "That point," being the time you decided to not use the
21 central computer system? A. Correct.

22 Q. Did you eventually build that exerciser?

23 A. Yes, I did.

24 Q. When did you complete building that exerciser?

25 A. Well, I guess you can say that-- What's to say when some-
26 thing is complete? It was complete when it went into production
27 at Nutting Associates. I mean, that was the first commercial
28 result of that. But I could move objects around on a screen

1 before that time.

2 Q. What time did it go into commercial production?

3 A. We sold our first units in December or January of the
4 following year. I guess that would be December '71 or January
5 '72.

6 Q. Did it go into production approximately the same time it was
7 first sold? A. Oh, yes.

8 Q. How long before it was first commercially sold would it
9 have gone into production?

10 A. Well, I think we were trying to get some units out as soon
11 as possible. We showed it at the show in I think it was
12 October-November, and as soon as--we were hoping to have
13 production units ready by then, but they just weren't and the
14 production units weren't really ready to ship until that
15 December.

16 Q. At what show did you show it?

17 A. Music Operators of America.

2 85546

18 Q. Where was the show held?

19 A. It was in a hotel in Chicago. The Palmer House, I believe.

20 Q. When you say you showed it at the show, was there an
21 operative game there at the show? A. Yes, there was.

22 But it was a lash-up. I carried the computers in my suitcase
23 to the show and we had shipped the cabinets ahead and brought
24 the computers in and installed them and babied them through.

25 Q. When did you commence your employment with Nutting
26 Associates? A. I think it was in March or April of

27 '71.

28 Q. I think you testified that you took the computers in a

1 suitcase. What computers are you referring to that you had in
2 your suitcase? A. The ones that were built for the
3 Computer Space.

4 Q. When was the first time that you had a completed apparatus
5 on which you could play the Computer Space game?

6 A. You say the Computer Space game. There was a lot of
7 variations and modifications to it.

8 Q. When was the first time at which you had an apparatus
9 completed in which you could play any version of Computer
10 Space?

A. Oh, it was probably April or May of
11 '71.

2 85547

12 Q. In connection with Exhibit 40-15, I think you said that you
13 wanted to make the system so you could play Spacewar or other
14 games. What other games did you have in mind at that time?

15 A. Well, I had in mind, you know, various sports games,
16 various arcade games that I had seen in school, you know, when
17 I was at the amusement park. I was thinking particularly of
18 baseball. I was also thinking of hockey.

19 Q. Do you have any documents which would show the games that
20 you contemplated using with your system at that time?

21 A. Yes, I do. Now, these are some of the files, some of which
22 are missing and I don't know why I'd have these and why I don't
23 have the others or why I have any at all. I think most of the
24 others are at Nutting. I also have my book in which I have just
25 essentially some of my cost estimates on the Nova and the PDP-8.
26 This is the company that I rented some time on a 16K Nova.

27 Q. Before you go any further, these files, I gather you were
28 pointing to four files, the first one marked "File No. 9

1 Q. Was that the same agreement as the agreement relating to
2 Computer Space? A. No. It was an employment
3 agreement that Nutting had.

4 Q. Was there a separate agreement from the employment agreement
5 which dealt with your retaining rights to video technology?

6 A. No. That kept my rights to video technology.

7 Q. That is, the employment agreement?

8 A. Right. The agreement that specified the rights that I was
9 conveying to Nutting was in a separate agreement which spelled
10 out the payment terms and things for Computer Space. I was
11 listing each game individually. 2 85548

12 Q. Were there any agreements on any other games other than
13 Computer Space? A. Yes. We had an agreement on

14 a game called Two Player Computer Space.

15 Q. Were there any other agreements relating to games with
16 Nutting? A. No, there weren't.

17 Q. Can you describe for us the game Two Player Computer Space?

18 A. It was essentially two rocket ships fighting one another
19 in a star field. It's much closer to Spacewar than Computer
20 Space was because it didn't have the computer-operated flying
21 saucer. Or it did have it. It was one or two-player. You
22 could play against the computer or you could play against the
23 other rocket ship. Computer Space was just a single-player game
24 and could only be played by one person.

25 Q. Did Nutting ever commercially manufacture the Two Player
26 Computer Space game? A. Yes, they did.

27 Q. Do you know when they commenced this manufacture?

28 A. I think it was shortly after I left. Not shortly after I

1 left, I think it was the following fall.

2 Q. For how long did they manufacture that game?

3 A. I have no idea. It was my impression that the game was
4 a mistake and I didn't think it was a good idea. It was one of
5 the items preceding the disagreement on which I left. I think
6 history bears me out that I was right on it.

7 Q. Did they manufacture it for a period of months or a period
8 of years or-- A. I have no idea.

9 Q. Do you know how much they sold that game for? 2 85540

10 A. I think it was \$1500 or something like that. Very expensive.

11 Q. Nutting, I assume, did commercially manufacture the Computer
12 Space game? A. Yes, they did.

13 Q. Do you know how much they sold that for?

14 A. Yes. They started out at \$1,295. Or was it \$1,195? Some-
15 thing like that. It was either \$1200 or \$1295. I think they
16 later dropped the price to \$950.

17 Q. I think you testified earlier that they started their
18 commercial production in either December of '71 or January of '72?

19 A. Correct.

20 Q. Do you know how long that game was in commercial production
21 at Nutting? A. I think they produced that through

22 to the following fall. I think they produced Computer Space up
23 until they got Two Player Computer Space into production.

24 Q. Do you know how many units of Computer Space they sold?

25 A. I think it was about 13 to 15 units. Since I got a royalty
26 on it I probably have got the figure around somewhere for sure.

27 Q. Do you know how many units of Two Player Computer Space they
28 sold? A. I have no idea.

2 85550

23 Q. After you left Nutting, what was the first video game that
24 you think you worked on?

25 A. A game called Asteroid.

26 Q. Was it known as Asteroid at the time you started working
27 on it?

28 A. That's what we called it around the
company.

1 Q. Was that similar to the game that was finally sold under
2 the designation Space Race?

3 A. That's correct. You will find in our papers that we often
4 have an in-house code name that doesn't always come to market
5 under that name.

6 Q. Is that name also known as a VP-1? A. Yes, it is.

7 Q. What was the next game you started working on after Asteroid?

8 A. It would have to be the game which is now called Pong.

9 Maybe for classification here, there were three of us that were
10 technical.

11 Q. "Three of us" in what that were technical?

12 A. Well, three of the employees of the then Sysygy Company were
13 technical and we each had our projects. Mr. Babney had the pin-
14 ball project which was part of the contract engineering for
15 Bally Corporation.

2 85551

16 I had the Two Player Computer Space design for Nutting as
17 well as the Asteroid design. The Asteroid design, incidentally,
18 had been actually started before Computer Space because of the
19 star field and all that other stuff. We thought that the first
20 game should be Computer Space, but it was an easier game to do
21 and we probably should have done that as our first entrance but
22 we didn't. So it was just really picking up on that design and
23 rejuvenating it.

24 Mr. Alcorn, when he came aboard, his first project was to
25 build a simulated tennis game. I only did about two days' work
26 on Space Race because I got bogged down in administrative
27 details and running the company other than design and was able
28 to finish up the Two Player Computer Space for Nutting, but

1 Mr. Alcorn ultimately finished the Space Race design.

2 Q. When did Mr. Alcorn come on board?

3 A. I don't know. I can check the records. It's in the spring.
4 It was shortly after leaving Nutting.

5 MR. ETLINGER: What year would that be, '72?

6 THE WITNESS: '72.

7 MR. WILLIAMS: Q. Shortly after you left Nutting?

8 A. Yes.

2 85552

1 When you are a little company you think that model numbers are
2 kind of window dressing.

3 Q. So the numbers were assigned sometime after the work on the
4 machines actually began? A. Yes.

5 Q. Did you give Mr. Alcorn the assignment of designing a
6 simulated tennis game? A. Yes, I did.

7 Q. How did you give him the assignment, was it orally or in
8 writing? A. It was oral.

9 Q. Do you know when you gave him that assignment?

10 A. The day he came to work.

11 Q. Can you state what the assignment was?

2 85553

12 A. Well, I told him to make a tennis game. I wanted the ball
13 to go back and forth horizontally. I wanted two men, two little
14 men with rackets to move around the play field controlled by a
15 joy stick with a button on top and when the button was pushed
16 the little racket in the man's hand goes like that (indicating).

17 Q. Indicating a striking motion?

18 A. Right. And that after a point is scored the ball would
19 appear on the screen and you would have to move your man behind
20 it to serve and bat the ball to the other side; that each time
21 a point was scored you would hear a sound of a crowd of thousands
22 cheering, which is an electronic circuit that you can make that
23 does sound like "Hurray," you know, applause, and I wanted a
24 distant "pop" when the ball hit and I wanted the ball to make a
25 different sounding "pop" when it hit the floor or the sides.

26 Q. Was Mr. Alcorn successful in developing a game as you have
27 just described? A. It's hard to say. We worked
28 very closely at the time and the game came together. Designing

1 a game is kind of like drawing a picture and you initially make
2 the big outlines and then the game is refined and refined and
3 refined sort of like coloring in the sections.

4 I would say the first thing that's done is the sync genera-
5 tor is built and the ball-motion circuitry is put together.
6 After that the paddle control is put in. Well, in an XY joy
7 stick it's just a linked potentiometer so in a lab environment
8 you generally don't go right to a joy stick. You go to two pots.
9 Before you go to two pots you go to one pot. 2 85554

10 We looked at the first thing that we had up on a screen
11 which was essentially a rectangular blob which would later be
12 cut by a diode matrix into the little man and the ball. But you
13 could also--you know, it's very easy to make it so that when the
14 ball and the paddle intersect instead of waiting for the
15 computer to detect the hitting motion, that it just automatically
16 bounces off.

17 That's the way we did the initial one. It didn't play
18 badly, you know. We played it a little bit and found that the
19 game was kind of fun. The problem we had was that the ball
20 speed was very high at the time and we had trouble returning
21 the serve. So we said, "Hey, let's play this a little bit more.
22 Let's slow the ball down."

23 Mr. Alcorn slowed the ball down and we played it some more
24 and now we could get the serve back, but the game was kind of
25 dumb. I mean, it wasn't that much fun, you know.

26 Oh. I'm leaving out one thing. In this kind of a hitting
27 motion we wanted the racket to do--

28 Q. The striking motion?

A. The striking motion. If

1 you struck the ball when your paddle was in this direction--
2 (indicating.)

3 Q. That is angled upward? A. Angled upward, we
4 wanted the ball to go up. If you hit it with the paddle perpendi-
5 cular we wanted the ball to go straight over and if you hit it
6 while it was in this thing obviously the ball would go down
7 (indicating).

8 Q. That is with the paddle angled downward?

2 30000

9 A. Right. So we had various angles that the ball could have
10 would be selectable. So we just selected which angle it bounced
11 based on where the paddle was. That was in the game, but later
12 it was going to be refined to detect coincidences of when the
13 paddle moved, you know, where it was so that it was not just a,
14 you know, get-in-front-of-the-ball kind of game, but a ball
15 hitting the paddle, you know, where it was. So that was in the
16 game. It played pretty fun, you know, it was pretty good. But,
17 again, the ball now was too slow, and we said, "Well, if it's too
18 slow, you know, if it needs to be slow to return the serve, but
19 it needs to be faster after you get good to be fun." I said,
20 "Well, why don't we just count the volleys and speed the ball
21 up as a function of volley increase." So that's how that came
22 into being. That was not part of the original design specifi-
23 cation that I gave to Mr. Alcorn. So we put that in and it was
24 fun. It was a good game.

25 Then we got into a big hassle. Mr. Alcorn didn't want to
26 put the crowd of thousands in. He thought that it was a waste
27 of time. He says, "Why not just a nice raspberry sound, sort of
28 like (demonstrating) you know," and he said he could do that a

1 lot cheaper.

2 I said, "Okay, put in the raspberry sound when it misses."
3 It was my idea that I wanted to cheer on the winner rather than
4 badmouth the loser. But he prevailed on me. So the honk sound
5 was put into the game on a miss. Digital scoring was put in.
6 The game played pretty well. So we said, thinking in the back
7 of our mind, "Hey, we've got this. We did it in a hurry. Let's
8 give this to Bally satisfying their contract, their contract
9 engineering. Then we can get off and get doing some of our own
10 stuff." 2 85556

11 So this was a full six months ahead of schedule from when we
12 were supposed to do it. So I thought, "Gee, this is great. The
13 money is still rolling in and we will have satisfied our contract
14 and happiness and bliss will reign in California." So I hopped
15 on an airplane with the prototype, took it to Bally, showed it
16 to Mr. Britts and Mr. Lally who is, I guess, the vice-president
17 of engineering at Bally.

18 Neither one of them liked it. The contract was so written
19 that they could refuse--you know, that I had to provide to them
20 an acceptable game, something that they accepted. So they said,
21 "Aw, you have to have two people to play it. Who's going to pay
22 a quarter to play ping pong on a TV screen," so on and so forth,
23 "Go back to the drawing boards, Nolan."

24 So I did. I climbed back on the airplane very dejected be-
25 cause I thought it was a great chance to get off. I said, "Well,
26 hell, we've got this game, it's designed. Let's put it in a
27 cabinet and see how much it earns."

28 We did that. It earned very well. We all jointly made the

1 decision that we were going to hock everything we had and go
2 into production. So we figured out exactly how many units we
3 could buy the parts for and hopefully have them sold by the time
4 we had to pay for the parts. We had developed a little bit of
5 credit in the valley at that time and so we made our first order
6 for 75 units which at that time represented about five times as
7 much money as we had or had hoped to even get. We made sure that
8 the parts came in all on the same day so that we could essentially
9 get them all built in a very big hurry and out and sold.

10 We did it and we were successful in being able to sell the
11 machines, and with that money we made a re-lease for I think
12 300 at that time which was out of sight because we were in, you
13 know, 1500 square feet of building. We ended up doing an awful
14 lot of assembly out in the parking lot. But that's essentially
15 what happened.

16 MR. WILLIAMS: Let's take a short recess.

17 (Short recess.)

2 85557

18 MR. WILLIAMS: Q. As I understand your prior testimony,
19 the game which eventually was known as Pong was developed after
20 you entered into the agreement with Bally Manufacturing?

21 A. That's correct.

22 Q. And Mr. Alcorn did not start working on the game until after
23 that agreement was entered into?

24 A. That's correct. I think so, yes. I can't remember the
25 exact chronology, but it was in the space of a week or a month
26 or something like that.

27 Q. I have here a copy of Bushnell Exhibit 2 which was marked as
28 an exhibit during your deposition in July of 1974. The first

2 85558

27

Q. Have you ever seen a demonstration game sold by Magnavox

28

under the name Odyssey?

A. Yes, I have.

1 Q. When did you first see such a game?

2 A. I saw it at some kind of a distributor meeting or showing
3 that they had in I think it was the Airporter Hotel by the
4 San Francisco Airport, and I don't remember the exact date.

5 Q. Do you remember the approximate date?

6 A. No. I think Magnavox probably knows when it was better
7 than I do.

8 Q. Do you recall whether it was prior to the time that you
9 entered into the written agreement with Bally?

10 A. Yes, it was prior to that. It was while I was still
11 employed at Nutting.

12 Q. So you must have seen it prior to the time that you
13 instructed Mr. Alcorn to develop the game which subsequently
14 became Pong?

A. That's true.

15 Q. Did anybody else go with you to the distributor meeting?

16 A. Yes. I think it was either Mr. Ralston or Mr. Geiman or
17 maybe both.

18 Q. Ralston? A. Yes. He was the sales manager for
19 Nutting. **2 85559**

20 Q. How do you spell Geiman?

A. G-e-i-m-a-n, I think.

21 Q. Did you go there as part of your employment with Nutting?

22 A. Yes, I did.

23 Q. Were you asked to go there?

A. Yes.

24 Q. By whom?

25 A. I think it was by Bill Nutting. I
26 mean, either him or Geiman. They had heard about it, that it
27 was a video game, and since we thought we were the only show in
28 town we thought we would like to see what was happening.

Q. Do you recall what you saw at the demonstration?

1 A. Yes. I saw a game. I believe I saw a handball game or,
2 you know, the thing that they called handball and the ping pong
3 game.

4 Q. Did you see any other games at that demonstration?

5 A. They had the rifle there, but it wasn't working.

6 Q. Did you see any other games operating other than handball
7 and ping pong? A. No, I didn't.

8 Q. Could you briefly describe the ping pong game that you
9 saw? A. Well, it was, you know, the light spot
10 that moved back and forth when you hit it with the paddles.

11 Q. The light spot was on the face of the television screen?

12 A. Right. 2 85560

13 Q. And the paddles were also displayed on the face of the
14 television screen? A. Right.

15 Q. How did they appear? A. They were square blobs.

16 Q. Were there any other objects on the screen other than the
17 paddles or the light spot? A. Not to my knowledge.

18 Q. Was there a line down the center of the screen?

19 A. I don't remember.

20 Q. Did you play the game that you saw? A. Yes, I did.

21 Q. Was there just one Odyssey unit being demonstrated or were
22 there a number of them?

23 A. I believe that there was only one.

24 Q. Which one of the games that you saw did you actually play?

25 A. I think I played both of them.

26 Q. Do you recall how long you were at the show?

27 A. No, I don't. It wasn't very long. A half-hour.

28 Q. Did you discuss what you saw at the show with anybody

1 associated with Nutting? A. Yes, I did.

2 Q. Who did you discuss it with?

3 A. Mr. Ralston, Mr. Geiman.

4 Q. Did you discuss it with Mr. Nutting?

5 A. I think on returning I did. 2 85561

6 Q. What was your discussion with Mr. Nutting?

7 A. Oh, I just said that it was, you know, a home unit, not
8 very interesting to play, no competition.

9 Q. Did you have any further discussion with Mr. Nutting about
10 the Odyssey unit? A. Concerning that? Oh, I can

11 remember telling him that I didn't think that it used the kind
12 of circuitry that we had. The motion was a little too erratic
13 to be digitally manufactured.

14 Q. What did you discuss with Mr. Ralston relating to the
15 Odyssey unit? A. Pretty much the same thing, that I

16 didn't consider that it was--you know, that it would ever be
17 competition for us in the coin-op. That it was, you know, not
18 a good game.

19 Q. What did you discuss with Mr. Geiman?

20 A. Pretty much the same thing.

21 Q. Did you discuss the features of the games as might be
22 applied to coin-operated games? A. No, I did not.

23 Q. When did you first meet Mr. Ted Dabney?

24 A. I guess the first day that I interviewed with Ampex.

25 Q. Did you discuss the Odyssey unit with Mr. Ted Dabney?

26 A. I must have. I mean, he was working at Nutting at the time.

27 Q. Do you recall what that discussion was?

28 A. No, I don't.

1 Q. What was Mr. Ted Dabney's position at Nutting at the time?

2 A. I think he was an industrial engineer.

3 Q. When did you first meet Mr. Alcorn?

4 A. While he was employed at Ampex.

5 Q. Was Mr. Alcorn employed at Nutting also?

6 A. No, he wasn't.

7 Q. Was he employed at Ampex up until the time he started work-
8 ing for Syzygy? A. No. Well, I hired him from

9 Ampex, but from the time I knew him at Ampex he was on a work-
10 study program and I think he, upon graduation, went to work for
11 another company in Los Angeles before returning to Ampex.

12 Q. Prior to the time you saw the Odyssey game at the distri-
13 butors' meeting you were just referring to, had you learned of
14 the existence of that game?

15 A. Through word of mouth somebody said that there was a game
16 going to be shown up there. I believe it was Mr. Nutting who
17 had learned of it first.

18 Q. When did you first learn of that game?

2 85562

19 A. When Mr. Nutting told me.

20 Q. Can you place that in time, say, with relationship to when
21 you went to the distributor meeting?

22 A. It was probably like a week in advance.

23 Q. What did Mr. Nutting tell you when he told you about the
24 game?

25 A. He says, "There's a TV game by
26 Magnavox I've heard of." He didn't know what Magnavox had on
27 their mind. We were afraid they were going to compete with us
28 in the coin-op. He thought we should find out what's happening.

Q. Did he describe the types of games that you could play on

1 the Odyssey unit at that time to you?

2 A. I don't believe he knew. I'm not sure. I really don't
3 remember.

4 Q. Prior to the time when Mr. Nutting told you about the
5 Magnavox game did you have any knowledge of any activities of
6 any other companies in the field of video games?

7 A. None. Oh, let me take that back. There was a company that
8 was attempting to do a Spacewar using a mini computer, and I
9 believe we were aware of that. Somebody here in Menlo Park.

10 Q. Do you know the name of that company?

11 A. No, I don't.

2 85563

12 Q. Do you know the name of anybody associated with that
13 company?

A. A guy named Bill Pitts.

14 Q. So as of the time when Mr. Nutting told you about the
15 Odyssey game you had no knowledge of any activities by any
16 companies other than Nutting or the company of Mr. Pitts relat-
17 ing to video games?

A. Correct.

18 Q. When did you first learn that Sanders Associates was doing
19 work in the field of video games?

20 A. I believe that was subsequent to my finding out that
21 Magnavox had a patent and upon seeing the patent I saw that it
22 was assigned from Sanders Associates.

23 Q. When did you find out that Magnavox had a patent?

24 A. It was sometime after I came back from Chicago. I think
25 one of the guys from Bally said that there was a Magnavox
26 patent.

27 Q. Was that after the time that you went to the distributor
28 meeting and saw the Odyssey game?

1 Associates? A. It was after.

2 Q. As I understand your testimony yesterday, the game apparatus
3 which you commenced building in 1970 along the lines indicated
4 in your prior paper that you wrote while at the University of
5 Utah was intended to use a raster scan cathode-ray tube display
6 system? A. That's correct.

7 Q. When did you first decide that you wanted to use a raster
8 scan cathode-ray tube display system in that apparatus?

9 A. Probably it was coincident with the time that I decided to
10 pursue this on an active basis. 2 85564

11 Q. What time was that? A. It was the early spring.

12 Q. Of 1970? A. Yes.

13 Q. For what reason did you decide to use a raster scan cathode-
14 ray tube display instead of some other type of cathode-ray tube
15 display system?

16 A. I felt cost, and, you know, it was a consumerized manufactured
17 version rather than a scientific item. It was just a more cost-
18 effective solution.

19 Q. That is, the cost of the raster scan system was more cost
20 effective than some other type of scan system you might have
21 used? A. Any other system I knew of.

22 Q. In the monitor system which you did actually build what
23 apparatus did you use for the cathode-ray tube display portion?

24 A. Oh, I used an old--it was either a Dumont or a Sears, Roebuck
25 television set and I also used a small Miratel monitor.
26 I really used both of the units in the development.

27 Q. Did you use the TV set that you referred to in the first part
28 of the development and then switch to the Miratel monitor, or did

1 you use them both at the same time?

2 A. I think the Miratel was used first.

3 Q. Was there a model number on that?

4 A. There probably was. I have no idea what it was. It was
5 gray, about that long (indicating) and had about a 10-inch
6 screen.

7 Q. About how long did you indicate?

8 A. About two feet. 2 85565

9 Q. Where did you obtain the Miratel monitor?

10 A. We bought it from a surplus scrap dealer in Mountain View.

11 Q. Why did you stop using the Miratel monitor and go to the
12 Dumont or Sears, Roebuck TV set?

13 A. Well, the Miratel was a high resolution 525 line machine
14 and I think it had like a 10-megahertz video amplifier in it
15 and we wanted to see what our machine looked like on a crappy
16 standard consumer--we also wanted a bigger screen.

17 Q. Was the TV set which you used one which was capable of
18 receiving television broadcast signals, at least prior to the
19 time you started using it?

20 A. Before we got it, yes. After that we disabled the other
21 junk in it.

22 Q. What part of the TV set did you disable?

23 A. Well, we just tied into the video amplifier. That's so that
24 the IF and RF sections were not used.

25 Q. Did you make any other alterations to the TV set?

26 A. I think we used the audio amplifier as well.

27 Q. Did you modify the audio amplifier any?

28 A. I can't remember. I think the set was slightly over-scanned